

Reinventing the Wheel

Objective

Students will examine the financial and environmental impacts that electric buses could have on their community.

Curriculum Focus

Science
Math

Materials

- Access to research materials: internet, books, magazines
- Copies of “Student Sheet: Electric and Diesel Comparison”

Key Vocabulary

Greenhouse gas emissions
Miles per gallon equivalent (MPGe)

Learning Standards

Next Generation

MS-ESS3 - 3
HS-ESS3 - 4



Introduction

Each year, over half of America’s public school students ride nearly half a million diesel fueled buses that collectively release over 5 million tons of greenhouse gas emissions into our environment. Greenhouse gases, most commonly carbon dioxide, methane and nitrous oxide, in high amounts can trap heat in our atmosphere and warm the planet. On average, replacing one diesel bus with a zero emission electric bus is the equivalent of removing 5 cars or 23 tons of greenhouse gases each year. While electric buses have a higher upfront purchase price, they are known to have reduced maintenance and fuel costs as well as added environmental benefits.

As in other electric vehicles (EVs), electric buses do not have a traditional engine or fuel tank. Their electric motor is powered by high-voltage batteries that convert chemical energy into electrical energy. Electric bus batteries can last for up to 15 years and have a charging time of 3 to 8 hours, depending on battery capacity and charger type. They have similar capacity to traditional school buses, up to 83 passengers in some models. Electric buses can reach top speeds of 60 mph via a 250 kW battery which is the equivalent of a 335 horsepower engine. According to the U.S. Department of Energy, a diesel powered school bus averages 6.2 mpg while electric buses are projected to get 25 to 34 miles per gallon equivalent (MPGe) depending on battery capacity. These buses are also useful in our communities as they can be charged at night during off-peak hours when energy consumption is low. They can also store additional energy that can be sent back to utility companies in case of an emergency.

In this activity, students will examine the immediate and long term impacts electric buses can have on their community and the environment over time. Give students the worksheet below which they will use to calculate the impact and cost savings associated with electric buses before envisioning what those savings could provide for their school.



Procedure

1. Show students this video from PBS to introduce them to electric buses and their potential impact:
“Inside California Education: Charged – America’s Largest Electric School Bus Fleet” at youtu.be/Tj1yPvK9yaQ.
Then, discuss what stood out to them most about electric buses from the video. How do they think going electric would affect their daily commutes?
2. Review the facts from this lesson’s introduction, then distribute the student activity sheet below for each student to complete.
3. Once section 1 is completed, have students move on to section 2 and research the price of three resources they would enjoy having in the classroom. Then students will calculate how many resources they could purchase with their annual electric bus cost savings.



Discussion

- Discuss students’ findings from this activity along with how the cost savings and emission reductions would affect them over time. How would students want the school to spend these hypothetical savings?



To Know and Do More

- Students can personalize this activity by researching the current kWh and gasoline prices locally and building that into their calculations.
- Students can also research how many diesel buses are used by their school district and calculate the fuel and pollution savings for the entire school district if they went electric.

Student Sheet: Electric and Diesel Comparison

Section 1

	Electric Bus	Diesel Bus	Difference
Air Pollution			
1 year pollution	0	6,672 grams	Diesel pollutes 6,672 grams more than electric annually.
5 year pollution			_____ pollutes _____ more than _____ annually.
10 year pollution			_____ pollutes _____ more than _____ annually.
Cost (per 12,000 miles/year)			
1 charge/tank	120 miles = \$15.50	496 miles = \$250.40	
1 year	\$ _____ per year $12,000/120 \times 15.50$	\$ _____ per year $12,000/496 \times 250.40$	_____ costs _____ more than _____ annually.
5 years	\$ _____ per 5 years	\$ _____ per 5 years	_____ costs _____ more than _____ every 5 years.
10 years	\$ _____ per 10 years	\$ _____ per 10 years	_____ costs _____ more than _____ every 10 years.

Section 2

Item (average price)	Annual Savings Applied
High school math textbook (\$66.26)	= _____ more text books
12 pack dry erase markers (\$8.44)	= _____ more 12 packs of markers
_____	= _____ more _____
_____	= _____ more _____
_____	= _____ more _____